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ABSTRACT

Mathematics instruction in junior high schools in Tokyo and Hawaii was compared in order to gain knowledge of how mathematics teachers' effectiveness in the classroom may be improved. Because they were likely to influence teachers' behavior, these factors were considered: teachers' background and teaching load, allocation of time, views on effective teaching, relative emphasis of instructional objectives, instructional behavior, and use of calculators. The 89-item questionnaire is included in the appendix, with two items about Juki institutions in Japan. In Tokyo, 100 schools were randomly selected and each was sent two questionnaires; 67 replies were received. In Hawaii, all 90 schools were invited to participate; 71 questionnaires were returned. Among the results are: (1) in Hawaii, the percent of female teachers is about twice that in Japan; (2) teachers in Hawaii take fewer mathematics methods courses; (3) the class period is shorter but the number of school days greater in Tokyo; (4) teachers in Hawaii spend twice as much time grading papers and tests; (5) teachers in Hawaii spend more time explaining new homework, while Tokyo teachers spend more time lecturing or explaining to the whole class; and (6) calculators are used more in Hawaii than in Tokyo. (MNS)

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MATHEMATICS INSTRUCTION IN TOKYO'S AND HAWAII'S JUNIOR HIGH SCHOOLS

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Mathematics Instruction in Tokyo's and Hawaii's Junior High Schools

Final Report

University of Hawaii, Honolulu, Hawaii
National Institute for Educational Research, Tokyo, Japan

1986

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PART I INTRODUCTION

The National Council of Teachers of Mathematics (NCTM, 1980) has identified the application of stringent standards of both effectiveness and efficiency to the teaching of mathematics as one of eight areas in which attention must be given to improve mathematics instruction during the 1980s. In its mid-decade report, the NCTM stated that "further efforts are needed toward increasing the efficiency and effectiveness of the mathematics teachers" (NCTM, 1984). The purpose of this study is to compare mathematics instruction in Tokyo's and Hawaii's junior high schools in order to gain knowledge and insights into how a mathematics teacher's effectiveness in the classroom may be improved. Results from the second international mathematics study (IEA, 1984) show the mathematics achievement of Japan's 13-year olds to rank first among 20 nations. The United States' ranking was at the median or below. It is of great interest and value therefore to find out how mathematics classroom instruction in Tokyo compares with that in the United States, and in Hawaii in particular.

Informal observation made in selected schools in Japan in 1983 and in Hawaii schools over the past decade have suggested some distinct differences. This study attempts to determine if the differences noted apply to a larger group of teachers in Tokyo and in Hawaii. The differences suggested by the informal observations provided one of the bases on which the survey instrument for this study was designed. The classroom behavior, thinking, and planning of effective mathematics teacher as

identified by Evertson, Emmer and Brophy (1980); Evertson et al. (1980); Good & Grouws (1983); and Smith (1977) provided yet another basis for designing the survey instrument.

Specifically, the following variables were studied because they were likely to influence teachers' behavior and hence their effectiveness in the classroom or they were behavior that might affect the teachers' effectiveness:

1. Teachers' background and teaching load. The amount of mathematics and pedagogy studied, the total number and length of teaching periods, and the nature of the courses taught may all have an influence on teacher bahavior. In fact, teacher educational background may influence teachers' allocation of class time for various activities.
2. Teachers' allocation of time. Whether classtime is used for lecturing or explaining to the whole class or whether there is much time devoted to individual work are factors that may affect teacher effectiveness. This allocation of time by the teachers indicates their views on teaching effectiveness.
3. Teachers views on effective teaching. In addition to their views on classtime allocation, the teachers' other views on teaching effectiveness may influence their behavior in the classroom. The teachers' views on effective teaching may also be influenced by the emphasis that teachers place on different mathematics instructional objectives.

4. Teachers' relative emphasis of instructional objectives. Whether teachers feel that students should develop an attitude of inquiry more than perform computations with speed and accuracy may influence their classroom behavior. Also whether teachers emphasize that students understand the nature of proof or whether they emphasize that students should become interested in mathematics may influence the teachers' behavior.

5. Teachers' instructional behavior. The teachers' actual instructional behavior pertaining to the involvement of students in instruction, tasks, and activities, to the monitoring of students' progress in learning and completing tasks, and to providing instructional feedback to students all may influence their teaching effectiveness.

6. The use of calculators. The use of the calculator has radically reduced the demand for some paper and pencil techniques. Are teachers taking advantage of this fact by the use of calculators in the classroom? Calculators may also assist teachers in teaching certain concepts and skills considered difficult to teach, for example, the teaching of problem solving.

PART II METHODOLOGY
The Survey Instrument

The survey instrument consists of 89 items. (See Appendix A) Most of these items are adaptations of items developed by the Far West Laboratory for Educational Research and Development and by the International Association for the Evaluation of Educational Achievement (IEA) for the Second International Study of Mathematics.

The questionnaire consists of items pertaining to the following categories:

1. Teacher Background. Items here seek information on sex, age, years of teaching experience, and mathematics and pedagogy education.
   (Teacher Background: 1-5)* (1-7)**
2. Teacher Instructional Behavior. Teachers are indirectly asked whether they (a) actively present instruction and information, (b) establish and maintain the engagement of students in instruction, tasks, and activities, (c) monitor students' progress in learning ,and (d) provide instructional feedback to students. For example, teachers are asked whether they always, frequently, sometimes, occasionally, or never (a) state what students are to learn in the lesson, (b) sustain momentum in the lesson, not letting it slow down, (c)

*Numbers to the Hawaii version of the questionnaire.
**Numbers to the Tokyo version of the questionnaire.

review students' work when it is completed, and (d) model appropriate responses for students.

(Part I: 1-25, Part II: 1-2, Part III: 7-8)*

(8-34, 41-42)**

3. The Teaching Load. Questions here seek information on total number of teaching periods, the length of each class period, and the nature of the mathematics subject matter taught, i.e., remedial, typical, or enriched and accelerated.

(Part III: 1-5)* (35-39)**

4. Use of Time. Questions in this category first ask information on how much time outside of class the teacher uses in preparing for class and in grading papers, quizzes, and tests. Secondly, questions on how the teacher uses the class time are included in this category. For example, the teacher is asked to indicate what percent of time is spent in a class period in checking homework, lecturing or explaining to the whole class, having children work individually, or in groups, and in explaining homework. Thirdly, teachers are asked how much time is needed by students to do the homework assigned.

(Part III: 6, 9, 10)* (40, 43, 44)**

5. Teachers' Views on Effective Teaching. Teachers are asked to rate each of 41 suggestions of what teachers might do to make teaching more effective.

(Part IV)* (45-85)**

6. Teachers' Relative Emphasis of Mathematics Instruction Objectives. Teachers are given 9 objectives of mathematics instruction and asked to indicate for each objective the emphasis it is given relative to the other objectives. (Part VI)* (89)**

7. The Calculator. Teachers are asked in which subject in their school the use of calculators is encouraged. Also, questions are posed regarding their department's policy, if any, on the use and provision of four function and pre-programmed multifunction and/or programmable calculators in the classroom.
(Part V: 1-3)* (86-88)**

In additions to these categories, the Tokyo version contains two items about "Juku" school participation. (90-91)** "Juku" schools are informal institutions that Japanese students might attend in addition to their regular schools.

The question format between the Hawaii and Tokyo versions differed for a few items. Under Teacher Background, for items 1 and 5a-c (5-7)*** the responses were "open-ended" in the Hawaii version whereas the responses were "multiple choice" in the Tokyo version. For items 2 and 3 (2,3)*** Hawaii teachers indicated "years" whereas Tokyo teachers indicated "years and months." Under Part II, for item 1 (33)*** the responses were "multiple choice" in the Hawaii version and "open-ended" in the Tokyo version. Under Part III, for item 3 (37)*** the choices of general school administrator and subject area administrator were

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***Numbers in parenthesis refer to items in the Tokyo version.

combined into a single choice in the Tokyo version. For Part VI (89)*** in the Hawaii version teachers' responses were not for grades i.e., by 7th, 8th or 9th grade, whereas in the Tokyo version teachers' responses were for grades.

Target Populations

In Japan the target population is both public and private junior high school teachers of mathematics in Tokyo. In Hawaii, the target population is public junior high school teachers of mathematics in the State of Hawaii.

In Tokyo, in 1983, there were 837 junior high schools: grades 7,8, and 9. Of these, 644 (77%) were public, 185 (22%) were private, and 8 (1%) were national.* The number of junior high school teachers was 22,507. Of these, 14,118 (63%) were male and 8,389 (37%) were female. The total number of junior high school mathematics teachers in Japan was 37,332. In 1985, there were 838 junior high schools in Tokyo.

In 1984, in Hawaii, there were 90 schools that contained at least one of the grades: 7, 8, or 9. The various organizations of schools by grades were 7-8, 7-9, 9-12, 7-12, K-8, K-12, K-9, and 6-8. The number of junior high school teachers was about 1,291. The number of secondary teachers (grades 7-12) in 1985 was 3,476. Of these 45% were female and 55% male.

The number of junior high schoool mathematics teachers was about 450. If a teacher taught at least one mathematics class in grades 7, 8, or 9, the teacher was considered a mathematics teacher.

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*National schools are run by the Ministry of Education in Japan.

Procedure

In Tokyo, 100 schools, 77 public schools and 23 private schools were selected at random from a possible number of 838. Two questionnaires were sent to each school making a total of 200 questionnaires sent. Forty-six schools, 39 public and 7 private, returned the questionnaires. Both teachers from 21 of the schools returned questionnaires, and only one of the two teachers from 25 of the schools did. In total, 67 questionnaires were returned, 56 from public school teachers and 11 from private school teachers.

In Hawaii, all public junior high schools were invited to participate. Except for one school district, questionnaires were distributed from the district office to the schools. For the one exception, the questionnaires were sent directly to the schools by the project. Memos from the district and project office made clear to the school principals that teacher participation was voluntary. A total of 71 questionnaires were returned.

PART III RESULTS

Teacher Background

Table 1 presents seven teacher background variables: sex, age, teaching experience, mathematics teaching experience, number of mathematics courses taken, number of mathematics methods courses taken and number of general methods courses taken by Tokyo and Hawaii teachers. Of the junior high school mathematics teachers in Tokyo 30% are female and 70% are male as compared to 62% female and 38% male in Hawaii. The mean age for Japan teachers is 39.6 and for Hawaii teachers 39.9 with the standard deviation being greater in Tokyo than in Hawaii, 11.7 compared to 8.4.

Tokyo teachers have 15.2 years teaching experience 14.5 years of which are in teaching mathematics. Hawaii teachers have 14.3 years of teaching experience 12.7 years of which are in teaching mathematics. Again the standard deviation for Tokyo teachers is greater than that for Hawaii teachers. The standard deviations for Tokyo teachers are 12.2 (teaching experience) and 11.8 (math teaching experience) compared to the corresponding standard deviations of 8.3 and 8.3 for Hawaii teachers.

The mean number of mathematics courses taken is 8.0 for Tokyo teachers and 7.9 for Hawaii teachers. The standard deviation for Hawaii teachers is 5.6 compared to 1.6 for Tokyo teachers. The mathematics background, as far as number of courses is concerned, is much more uniform in Tokyo than in Hawaii. Tokyo teachers take more courses in the teaching of mathematics than Hawaii teachers. They take a mean of 4.5 courses as compared to 2.8 for Hawaii teachers. The difference

is significant. The standard deviations for both groups of teachers are essentially the same, 2.4 for Tokyo and 2.8 for Hawaii. The mean number of general methods courses taken by Tokyo and Hawaii teachers are respectively 4.5 and 4.7. Again Tokyo teachers' educational background is more uniform. Their standard deviation for number of general methods courses taken is 2.5 compared to a standard deviation of 4.3 for Hawaii teachers.

Table 1 Tokyo and Hawaii Teacher Backround

	Tokyo			Hawaii			
Variable	N	$\bar{X}$	SD	N	$\bar{X}$	SD	t
Sex: M	47			27			
F	20			44			
Age	67	39.6	11.7	70	39.9	8.4	0.17
Teaching Experience	67	15.2	12.2	70	14.3	8.3	-0.48
Math Teaching Experience	67	14.5	11.8	71	12.7	8.3	-1.06
# of Math Courses Taken	67	8.0	1.6	63	7.9	5.6	0.23
# of Math Methods Courses Taken	64	4.5	2.4	58	2.8	2.8	-3.55*
# of General Methods Courses Taken	66	4.5	2.5	51	4.7	4.3	0.32

* $p < .01$

Teaching Load

In Tokyo the average number of minutes in the class period is 49.7 minutes and in Hawaii 55.0. (See Table 2) This difference is significant. In Tokyo there is less variation in the length of class time than in Hawaii classrooms. In Tokyo the standard deviation is 1.2 and in Hawaii it is 11.2.

Table 2 The Number of Minutes in the Class Period in Tokyo and in Hawaii

	Tokyo			Hawaii			
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	t
# of Minutes in Class Period	67	49.7	1.2	69	55.0	11.2	3.8*

* $p < .01$

In Table 3, we see that both Tokyo and Hawaii teacher have about 19 hours per week of class contact periods. Seventeen of these are in teaching mathematics. However, in Hawaii the variation among teachers of total contact teachings periods and in teaching mathematics is greater than that in Tokyo. In Tokyo the standard deviation for the total number of class contact periods is 3.3 and for the number of teaching mathematics periods is 2.3. In Hawaii the standard deviations are correspondingly 9.6 and 9.7. Again, we see more variation about the Hawaii means than the Tokyo means.

Table 3 Class Contact Periods for Tokyo and Hawaii Teachers

Variables	Tokyo N	Tokyo $\bar{X}$	Tokyo SD	Hawaii N	Hawaii $\bar{X}$	Hawaii SD	t
Total Number of Class Contact Periods	67	19.2	3.3	70	19.4	9.6	0.1
Number of Mathematics Teaching Contact Periods	66	17.3	2.3	70	16.6	9.7	-0.5

Table 4 Percent of Teachers in Tokyo and Hawaii Who Have Duties In Addition to Teaching Mathematics

Additional Duties	Tokyo N=67	Hawaii N=71
Teacher of Science	00	04
Teacher of Other Subject Areas	03	32
Chairman of the Mathematics Department	48	23
* School Administrator-General	00	00
* School Administrator-Subject Area	00	03
Other	40	28

* These choices were combined into a single choice in the Tokyo version of the questionnaire.

Table 4 shows that in addition to teaching mathematics, teachers both in Tokyo and Hawaii had additional responsibilities. In Tokyo these additional duties were teacher of other subject areas (3%), chairman of the mathematics department (48%) and other (40%). In Hawaii these duties were

teacher of science (4%), teacher of other subject areas (32%), chairman of the mathematics department (23%), subject area school administrator (3%), and other (28%).

Teachers classified their classes as being remedial, typical, or enriched or accelerated. According to Table 5, in Tokyo 3.1% classified their classes as remedial, 86.6% as typical, 9.0% as enriched or accelerated, and 1.5 % gave no response. In Hawaii 22.5% of the teacher classified their classes as remedial, 67.7% as typical, 4.2% as enriched or accelerated, and 5.6% indicated no response.

Table 5 Classification of Mathematics Classes Taught by Tokyo and Hawaii Teachers

Class Classification	Tokyo N=67		Hawaii N=71	
	N	percent	N	percent
Remedial	2	3.1	16	22.5
Typical	58	86.6	48	67.7
Enriched or Accelerated	6	9.0	3	4.2
No Response	1	1.5	4	5.6

Use of Time

How teachers in Tokyo compare with those in Hawaii regarding the use of classtime, the amount of time spent outside of class for selected activities for the class, and the amount of time that is expected of students to do homework for the class is presented below.

As seen in Table 6 teachers in Tokyo and Hawaii spend about two hours and thirty miutes per week preparing and planning for one mathematics class. However, in both places there is substantial teacher variation. Teachers in Tokyo spend almost 2 hours per week per class grading papers, quizzes, and tests whereas in Hawaii the teachers spend almost 4 hours per week per class. This difference is significant. In both places there is substantial variation among teachers.

Table 6 Minutes Spent Per Week Per Class Outside of Class for Selected Class Activities by Tokyo and Hawaii Teachers

	Tokyo			Hawaii			
Activity	N	$\bar{X}$	SD	N	$\bar{X}$	SD	t
Grading papers, quizzes, & test	64	110.9	103.3	68	232.0	184.7	4.66*
Preparing & planning for class (excluding the above activity)	63	149.2	199.6	67	143.3	123.6	-0.20

* $p < .01$

The percent of time that teacher in Tokyo and Hawaii spend in class checking homework, lecturing or explaining to the whole class, having children work individually or in groups, and

explaining new homework is seen in Table 7. For all of the activities there is great teacher variation. However, Hawaii teachers tend to have students work individually and in groups more of the time than do Tokyo teachers. The difference in amount of group work is statistically significant. Hawaii teachers spend more than three times the amount of time explaining new homework than do Tokyo teachers. In Tokyo teachers spend about 5% of the class time as compared to about 16% in Hawaii. This difference is significant. Tokyo teachers spend about 8% more class time explaining or lecturing to the whole class than Hawaii teachers. This is a statistically significant difference.

Table 7 Percent of Time in Class Spent on Various Activities by Tokyo and Hawaii Teachers

	Tokyo			Hawaii			
Activity	N	$\bar{X}$	SD	N	$\bar{X}$	SD	t
Checking homework	67	13.7	8.3	67	12.5	8.6	-0.80
Lecturing or explaining to the whole class	67	39.8	15.2	69	31.7	14.7	-3.16**
Having children work individually	67	30.6	13.1	68	35.7	16.9	1.96
Having children work in groups	67	2.2	4.7	52	5.7	10.1	2.48*
Explaining new homework	67	5.1	4.9	58	16.5	9.8	8.42**
Others	67	8.1	8.8	44	7.2	5.8	-0.58

* $p < .05$. ** $p < .01$

Hawaii teachers expect per week 6 hours more of homework time of their students than do Tokyo teachers. (See Table 8) Hawaii teachers expect 7.7 hours per week and Tokyo teachers expect 1.7 hours per week. In both teacher groups there is substantial individual variation.

Table 8 Amount of Homework Time Per Week Expected of Students by Tokyo and Hawaii Teachers

	Tokyo			Hawaii			
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	t
Homework Time Expected	67	1.7	1.1	69	7.7	16.4	3.03*

* $p < .01$

Teachers' Views on Effective Teaching

Both in Tokyo and Hawaii teachers were asked to rate each of 41 suggestions of what to do to make teaching more effective. Thirteen items were rated by Tokyo teachers (80% or greater) as being of major importance or among the highest in importance. These are listed below:

Plan transition from one activity to another. (rated by 85% of the teachers)

Make encouraging remarks to individual students as they work. (90%)

At the end of a period, summarize the material that has been taught during the period. (85%)

Think about how to clear up instructional problems which have arisen in the course of a previous lesson. (84%)

Try to develop warm, personal relationships with students. (90%)

Allow discussion to continue longer than planned when students show particular interest. (84%)

Provide an opportunity for students to discover concepts for themselves. (84%)

Get materials, equipment, and space ready before class. (84%)

Make presentations as lively as possible. (94%)

Write meaningful comments as well as grade on student work. (81%)

Review tests with students shortly after the tests have been graded. (88%)

Make sure that students know exactly what they should be doing at any given time. (89%)

Identify students who are in difficulty but do not ask for assistance. (90%)

Hawaii teachers (80% or greater) rated 21 items as being of major importance or among the highest in importance. This is approximately 1.6 times the number (13) of items so rated by Tokyo teachers. Only two items were rated by at least 90% of the Tokyo teachers as being in this category. Eight items were rated by at least 92% of Hawaii teachers as being in this category. Listed below are the twelve items rated by at least 87% of Hawaii teachers as being of major importance or among the highest in importance:

Make a special effort to praise students who are mathematically (94%) correct in what they say or do.

* Make encouraging remarks to individual students as they work. (92%)

Take action to deal with signs of student discomfort or distress. (87%)

Establish and enforce clear cut rules for acceptable student behavior. (97%)

Give frequent feedback on how well each student is doing. (94%)

* Think about how to clear up instructional problems which have arisen in the course of a previous lesson. (92%)

* Get materials, equipment, and space ready before class. (87%)

When in front of the class, avoid being critical about the answers of an individual student. (94%)

* Review tests with students shortly after the tests have been graded. (92%)

Anticipate and forestall student disturbances before they occur. (87%)

* Make sure that students know exactly what they should be doing at any given time. (94%)

* Identify students who are in difficulty but do not ask for assistance. (89%)

Six of these twelve items are identical to those selected by Tokyo teacher. (See the starred "*" items.)

Listed in Table 9 are items for which there is a significant mean difference between Tokyo and Hawaii teachers' beliefs about effective teaching. Of these 19 items, 9 are considered of major importance or among the highest in importance by either Hawaii or Tokyo teachers.

Table 9 Selected Mean Differences Between Tokyo and Hawaii Teachers' Beliefs About Effective Teaching

Items	Tokyo N	Tokyo $\bar{X}$*	Tokyo SD	Hawaii N	Hawaii $\bar{X}$*	Hawaii SD	t
+ Make a special effort to praise students who are mathematically correct in what they say.	67	2.7	0.8	70	3.4	0.6	5.86
Assign problems which require abler students to do more than follow examples that have already been demonstrated.	67	2.5	0.7	70	3.1	0.6	5.68
Immediately correct false statements made by students.	65	2.7	0.9	70	3.2	0.8	3.68
+ At the end of the period, summarize the material that has been taught during the period.	67	3.1	0.6	66	2.8	0.8	-2.40
Present the content in a highly structured fashion.	67	2.1	0.6	70	2.9	0.8	6.73
+ Take action to deal with signs of student discomfort or distress.	64	2.6	0.6	69	3.2	0.6	5.33
+ Establish & enforce clear cut rules for acceptable student behavior.	65	2.6	0.7	70	3.7	0.5	10.15
Vary the difficulty of questions posed in classroom discussion.	63	2.7	0.7	70	3.2	0.6	4.04

Table 9 (cont'd) Significant Mean Differences Between Tokyo and Hawaii Teachers' Beliefs About Effective Teaching

Items	Tokyo N	Tokyo $\bar{X}$*	Tokyo SD	Hawaii N	Hawaii $\bar{X}$*	Hawaii SD	t
+ Give frequent feedback on how well each student is doing.	66	3.0	0.7	70	3.3	0.6	2.90
+ Get materials, equipment, and space ready before class.	67	3.1	0.7	70	3.4	0.7	2.29
At the beginning of the period, outline the content to be covered.	66	2.8	0.7	70	3.0	0.7	2.07
+ Make presentations as lively as possible.	66	3.6	0.6	70	3.2	0.7	-3.60
In planning a lesson, try to anticipate the questions that students might pose during class.	67	2.8	0.8	70	3.2	0.7	2.88
+ When in front of the class, avoid being critical about the answers of an individual student.	65	2.4	0.9	70	3.4	0.6	7.63
Call on students who do not volunteer to answer questions.	66	2.4	0.7	70	2.7	0.7	2.27
Have something good to say about the answers students give in class, regardless of whether the answers are correct or incorrect.	66	3.1	0.7	70	2.8	0.8	-2.24

Table 9 (cont'd) Significant Mean Differences Between Tokyo and Hawaii Teachers' Beliefs About Effective Teaching

Items	Tokyo N	Tokyo $\bar{X}$*	Tokyo SD	Hawaii N	Hawaii $\bar{X}$*	Hawaii SD	t
Give abler students assignments with some problems which are truly difficult for them to solve.	66	2.0	0.6	70	2.8	0.7	6.98
+ Anticipate and forestall student disturbances before they occur.	65	2.9	1.0	69	3.3	0.7	3.04
Before an activity begins, give students detailed step-by-step directions on what they are to do.	66	2.6	0.8	69	3.3	0.8	4.86

* 4: among the highest in importance
3: of major importance
2: of some importance
1: of little or no importance

\+ considered of major or among the highest in importance by either Hawaii or Tokyo teachers.

Teachers' Relative Emphasis of Instructional Objectives

Both in Tokyo and Hawaii teachers were asked to indicate the relative emphasis they gave each of nine objectives in teaching their mathematics classes. Teachers indicated whether they gave an objective "more", "less", or "about equal" emphasis relative to the other eight objectives. Hawaii teachers gave more emphasis to developing a systematic approach to solving problems; knowing mathematical facts, principles, and algorithms; and developing an awareness of the importance of mathematics in everyday life. These objectives were given more emphasis by 56.0, 47.7, and 47.9 percent of the Hawaii teachers respectively.

Tokyo teachers gave more emphasis to becoming interested in mathematics, understanding the nature of proof, developing an attitude of inquiry, and performing computations with speed and accuracy. These objectives were given more emphasis by 44.8, 37.3, 37.3 and 37.3 percent of Tokyo teachers respectively.

In comparing the means of the relative emphasis given the nine objectives by Hawaii and Tokyo teachers, none of the means were found to be significant. (See Table 10)

Table 10 Relative Emphasis Given by Tokyo and Hawaii Teachers of Objectives in Teaching Mathematics

Objective	Tokyo N	Tokyo $\bar{X}$*	Tokyo SD	Hawaii N	Hawaii $\bar{X}$*	Hawaii SD	t
Understand the logical structure of mathematics.	64	1.9	0.7	66	1.9	0.7	0.13
Understand the nature of proof.	63	1.7	0.7	66	2.6	0.6	-1.41
Become interested in mathematics.	64	1.7	0.7	65	1.9	0.6	-0.47
Know mathematics facts, principles, and algorithms.	62	2.0	0.6	66	1.4	0.5	1.11
Develop an attitude of inquiry.	63	1.7	0.6	66	1.9	0.7	-0.27
Develop an awareness of the importance of mathematics in everyday life.	64	2.1	0.7	65	1.6	0.7	0.69
Perform computations with speed and accuracy.	62	1.7	0.7	66	1.8	0.6	-0.16
Develop an awareness of the importance of mathematics in the basic & applied sciences.	63	2.4	0.7	66	2.0	0.7	0.54
Develop a systematic approach to solving problems.	63	1.7	0.6	66	1.4	0.6	0.47

* 1: Relatively more emphasis, 2: About equal emphasis, 3: Relatively less emphasis.

Teacher Instructional Behavior

Both in Tokyo and Hawaii teachers were asked to indicate the frequency with which they showed 25 behaviors in their typical class period. Teachers could choose one of the following responses: Always, frequently, sometimes, occasionally and

never. In Table 11 are listed those classroom behavior for which there is a significant difference in means ($p < .05$ or $p < .01$) between Tokyo and Hawaii teachers.

As seen in Table 11 Tokyo teachers more than Hawaii teachers presented instruction and/or information by outlining the lesson before proceeding. On the other hand Hawaii teachers explained concepts, definitions, relationship of tasks to goals, etc; illustrated how to do the work, how to do a problem, etc; and answered students' questions about what they are to do. Tokyo teachers more than Hawaii teachers established and maintained the engagement of students in instruction, tasks, and activities by telling students to attend to tasks (whole class or individually). Hawaii teachers signaled students to get to work (turning off lights, eye contact, etc.) and encouraged students to keep up (maintain pace). Tokyo teachers more than Hawaii teachers monitored students' progress in learning and completing tasks by scanning the room to see if everyone is working, by monitoring students' responses, and by roaming the room checking students' work. Hawaii teachers on the other hand reviewed students' work when completed, questioned students on whether they completed work, learned a concept, or learned a fact, and collected students' work.

Table 11 Significant Mean Difference Between Tokyo and Hawaii Teachers' Classroom Behavior

Item	Tokyo N	Tokyo $\bar{X}$[a]	Tokyo SD	Hawaii N	Hawaii $\bar{X}$[a]	Hawaii SD	t
Outline the lesson before proceeding.	67	2.0	0.9	71	3.0	1.0	5.77**
Explain concepts, definitions, relationships of task to goals, etc.	67	2.2	0.7	71	1.6	0.7	-4.79**
Illustrate how to do the work, how to do the problem, etc.	66	1.6	0.6	71	1.2	0.4	-4.28**
Answer student's questions about what they are to do.	67	1.5	0.7	71	1.3	0.5	-2.12*
Tell students to attend to tasks (whole class or individually).	67	1.6	0.8	70	2.0	0.8	2.69**
Signal students to get to work (turn off lights, eye contact, etc).	65	4.6	1.1	71	2.1	0.9	-14.53**
Encourage students to keep up (maintain pace).	66	2.2	0.9	71	1.9	0.7	-2.23*
Scan the room to see if everyone is working.	67	1.2	0.4	71	1.6	0.6	4.99**
Review students' work when it is completed.	66	3.1	1.0	71	1.6	0.6	-10.49**
Monitor students' responses.	67	1.3	0.6	70	1.8	0.7	4.67**
Roam the room checking students' work.	67	1.4	0.6	71	2.0	0.7	5.35**
Question students: learned a concept, learned a fact, completed work.	67	2.3	1.0	70	2.0	0.7	-2.02*
Collect students' work.	67	2.5	0.8	71	1.4	0.7	-8.68**

* $p < .05$. ** $p < .01$

[a] 1: Always 2: Frequently 3: Sometimes 4: Occasionally 5: Never

When asked directly Tokyo teacher state that in a typical class period they establish and maintain the involvement of 70.9% of the students in instruction, tasks, and activities for 35.6% of the class period (See Table 12) Hawaii teachers when asked directly state that they establish and maintain the involvement of a little more than 75% of the students for slightly more than 75% of the class period. (See Table 13) It should be noted that the format used to obtain these percentages differed in the Hawaii and Tokyo version of the questionnaire. In the Tokyo version, teachers wrote in the percents, but in the Hawaii version the teachers selected one of four possible choices: 25%, 50%, 75% or 100%. It is likely that the Hawaii teachers' mean for percent of student involvement would be close to the Tokyo mean of 70.9% instead of slightly more than 75% if the Hawaii teachers also had written in the percents. It is unlikely, however, that the Hawaii teachers' mean for percent of classtime would be close to the Tokyo teachers' mean of 35.6% if Hawaii teachers wrote in the percents.

Table 12 Percent of Classtime and Percent of Students Involved in Instruction, Tasks, and Activities in a Typical Tokyo Classroom

Variables:	N	$\bar{X}$	SD
Classtime	64	35.6	24.2
Students involved in instruction, tasks, and activities	65	70.9	27.7

Table 13 Percent of Classtime and Percent of Students Involved in Instruction, Tasks, and Activities in a Typical Hawaii Classroom

Percent of:	N	$\bar{X}$*	SD
Classtime	67	3.1	0.6
Students involved in instruction, tasks, and activities	69	3.2	0.7

* 1 = 25% 2 = 50% 3 = 75% 4 = 100%

When asked for what percent of students in a typical class they monitored progress in learning and completing tasks and for what percent of students they provided instructional feedback, Tokyo teachers responded 37.5% and 24.0% respectively. Hawaii teachers responded correspondingly 84.2% and 82.0%. (See Table 14) The percent of students for which progress in learning and tasks completed are monitored and for which instructional

Table 14 The Percent of Students for Which Progress in Learning and Completing Tasks are Monitored and Instructional Feedback Provided in a Typical Class by Tokyo and Hawaii Teachers

	Tokyo			Hawaii			
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	t
Progress in learning & completing tasks monitored	63	37.5	29.8	68	84.2	22.6	10.1*
Instructional feedback provided	63	24.0	20.6	68	82.0	24.0	14.7*

* $p < .01$

feedback is provided is significantly greater in Hawaii than in Tokyo. The percent in Hawaii is over twice that in Tokyo for monitoring progress and task completion and is over three times that in Tokyo for providing instructional feedback.

In a typical week, during an average class period about 25% of the Hawaii teachers called upon up to 1/4 of the students in the class to answer oral questions, about 25% called upon more than 1/4 and up to 1/2, about 25% called upon more than 1/2 and up to 3/4, and about 25% called upon more than 3/4 of the class. (See Table 15) In Tokyo about 15% of the teachers called upon up to 1/4 of the students to answer oral questions, about 45% called upon more than 1/4 and up to 1/2, about 25% called upon more than 1/2 and up to 3/4, and about 15% called upon more than 3/4 of the class. (See Table 15)

Table 15 The Percent of Hawaii and Tokyo Teachers Who Called Upon Students to Answer Oral Questions

Amount of Students Asked	Tokyo, N=67 % of Teachers	Hawaii, N=71 % of Teachers
Up to 1/4 of the class	14.9	23.9
More than 1/4, up to 1/2	44.8	22.5
More than 1/2, up to 3/4	25.4	22.5
More than 3/4 of the class	14.9	26.8
No response	4.2	4.2

Both in Tokyo and in Hawaii some students are asked to do exercises or problems that are different from those given other students in the class. In Tokyo about 8% of the teachers

frequently make this kind of assignment, 58% occasionally do, and 35% rarely or never do. (See Table 16) In Hawaii about 17% frequently make this kind of assignment, 35% occasionally do, and 44% rarely or never do. (See Table 16) In essence both in Tokyo and Hawaii mathematics teachers never, rarely, or only occassionally ask some students to do assignments different from the rest of the class.

Table 16 Percent of Tokyo and Hawaii Teachers Who Ask Some Students to Do Assignments Different From the Rest of the Class

Frequency of Teacher Request	Tokyo, N=67 % of Teachers	Hawaii, N=71 % of Teachers
Frequently	7.5	16.9
Occassionally	58.2	35.2
Rarely or Never	34.3	43.7

The Calculator

When asked: "in your school in which subject(s) is the use of calculators encouraged? Check one," mathematics teachers in Tokyo and Hawaii responded as follows:

Subjects	Tokyo	Hawaii
None	(50) 74.6%	(23) 32.8%
Mathematics only	(8) 11.9%	(13) 18.3%
Science only	(2) 3.0%	(1) 1.4%
Mathematics and science	(3) 4.5%	(10) 14.1%
All or most subjects where appropriate	(2) 3.0%	(16) 22.5%
No response	(2) 3.0%	(8) 11.3%

A greater percent (74.6%) of Tokyo teachers reported that in no subjects is the use of calculators encouraged as compared to Hawaii teachers (32.4%). A greater percent (22.5%) of Hawaii teachers report encouragement of the use of calculators in subjects where appropriate as compared to Tokyo teachers (3.0%).

When asked to select a description that best described their departments' policy on the use by students of 'four function' and of pre-programmed multifunction and/or programmable calculators in the classrooms teachers' responses in Tokyo and Hawaii were as follows:

	Tokyo		Hawaii	
Description	A* calculator	B* calculator	A calculator	B calculator
No policy formulated.	35.8%	32.8%	60.6%	64.8%
Students forbidden to use calculators in class.	29.9%	23.9%	4.2%	1.4%
Students may use calculators but they are not provided by schools.	7.5%	16.4%	9.9%	4.2%
Calculators provided by schools but rarely used in class.	13.4%	7.5%	12.7%	1.4%
Calculators provided by schools and frequently used in class.	1.5%	1.5%	2.8%	1.4%
Question does not arise.	10.4%	14.9%	5.6%	19.7%
No response	1.5%	3.0%	4.2%	7.0%

* A = four function, B = preprogrammed multifunction and/or programmable

Both in Tokyo and Hawaii a substantial percent of the teachers indicated that no policy on calculator usage by students in their schools was formulated. In Tokyo the percent was as high as 35.8 and in Hawaii 64.8. In Tokyo when a policy was formulated, the policy forbade the use of calculators in classrooms. As high as 29.9% of the Tokyo teachers indicated that this policy exists in their schools. This percent compares to 4.2% of the Hawaii teachers who reported such a policy.

Thirteen and four tenths percent (13.4%) of the Tokyo teachers reported that four function calculators are provided by schools but rarely used in class. Nine and nine tenths (12.7%) percent of Hawaii teachers so reported.

"Juku" Participation

Based on estimates made by Tokyo teachers (See Table 17) approximately 42% of Tokyo seventh-grade students attend "Juku" institutions. In the eighth-grade about 48% attend "Juku" school, and in the ninth-grade about 55% do. At all grade levels the variation in teacher estimates is great. The standard deviation for grades seven, eight, and nine are 20.7, 22.4, and 23.3 respectively.

Table 17 Estimated "Juku" School Attendance of Tokyo Students in Grades 7-9 by Tokyo Teachers

Grade	N	$\bar{X}$	SD
Seven	32	42.3%	20.7
Eight	28	47.9%	22.4
Nine	30	54.8%	23.3

PART IV DISCUSSION

The results of this survey identified ways in which Tokyo mathematics teachers differ from Hawaii mathematics teachers in classroom instruction. In addition, it identified other differences including teachers background and teaching load, teachers' views on effective teaching, and the use of calculators in the classroom.

In Hawaii the percent of female teachers (62%) is about twice that in Tokyo (30%). Teachers in Hawaii take less mathematics methods courses. How this influences the type of explanations, activities in the classroom is not known. The teaching load in terms of contact periods is the same for both groups. However, the class period is shorter in Tokyo. In addition, the number of school days in Tokyo (243 days in IEA Study) is greater than in Hawaii (174 days). A large number (32%) of Hawaii teachers teach other subjects in addition to mathematics compared to Tokyo teachers (3%). This might be because these mathematics teachers are not majors in mathematics teaching. The classes that Hawaii teachers taught contained a larger percent (23%) of remedial classes than that of Tokyo teachers (3%). Because it is not an uncommon practice to assign remedial classes to non-math majors, this increases the chances that a large percent of junior high mathematics teachers in Hawaii are <u>not</u> mathematics majors. Seldom are junior high school mathematics teachers in Tokyo not mathematics majors.

In Hawaii teachers spend twice the amount of time Tokyo teachers do in grading papers, quizzes, and tests. The amount

cited by Tokyo teachers is close to that of United States eighth-grade teachers in the second international study (IEA, 1984). The impact of this effort at grading papers on student achievement and attitude is worth studying. Hawaii teachers also spend more time than Tokyo teachers in explaining new homework. On the other hand, Tokyo teachers spend more time lecturing or explaining to the whole class. Could it be that Hawaii teachers find themselves spending the amount of time explaining new homework because the skills, concepts, and generalizations needed to do the homework were not sufficiently developed prior to making the homework assignment?

Hawaii teachers compared to Tokyo teachers had students do more group work. However, group work occurred for a very small percent of time both in Tokyo and Hawaii classes.

Both Tokyo and Hawaii teachers when identifying effective teaching techniques emphasized factors such as 1) making encouraging remarks to students as they work, 2) thinking about how to clear up instructional problems which have arisen in the course of a previous lesson, 3) getting materials, equipment, and space ready before class, 4) reviewing tests with students shortly after the tests have been graded, 5) making sure that students know exactly what they should be doing at any given time, and 6) identifying students who are in difficulty but do not ask for assistance. Items (1), (3), and (4) were also three out of the four items listed by United States eighth-grade teachers in the second international study. The fourth item listed in the second international study was "establishing clear cut rules for acceptable student behavior." This item was also

considered of major or among the highest in importance by 97% of Hawaii teachers. However, this item was not emphasized by Tokyo teachers. Also Hawaii teachers more than Tokyo teachers emphasized the need to anticipate and forestall student disturbances before they occur. This suggests that in Tokyo there is less need to be concerned about classroom dicipline problems than in Hawaii or the United States.

Perhaps related to the concern for classroom dicipline, Hawaii teachers more than Tokyo teachers emphasize a more structured classroom. They present content in a highly structured fashion; at the beginning of the period, they outline the content to be covered; in planning a lesson, they try to anticipate the questions that students may pose during class; and before an activity begins, they give students detailed step-by-step directions on what they are to do.

Instead of emphasizing establishing and enforcing clear cut rules for students behavior, Tokyo teachers appear to emphasize the presentation of their subject matter. Making presentations as lively as possible was rated by 94% of the teachers (the highest percent for any item) of most or of greatest importance. This item and the item "at the end of a period, summarize the material that has been taught during the period "are two that Tokyo teachers compared to Hawaii teachers emphasize more. Tokyo teachers also emphasized more than Hawaii teachers the need "to have something good to say about the answers students give in class, regardless of whether the answers are correct or incorrect." Perhaps this emphasis is related to the Japanese

cultural notion that one should not be placed in a position "to lose face." Also Tokyo teachers less than Hawaii teachers call on students who do not volunteer to answer questions and immediately correct false statements made by students.

Hawaii teachers more than Tokyo teachers appear to emphasize the need to provide for individual differences in the classroom by assigning problems which require the abler students to do more than follow examples that have already been demonstrated, by varying the difficulty of questions posed in classroom discussion, by giving abler students assignments with some problems which are truely difficult for them to solve, and by asking abler students to do assignments different from the rest of the class. Hawaii teachers seem to be promoting the goal of "developing each individual to his/her fullest potential." On the other hand Tokyo teachers may find that providing for individual differences by differential assignments contrary to their concept and goal of providing equal educational opportunity for all students.

Hawaii teachers more than Tokyo teachers also appear to emphasize the needs of the individual student. As examples, they make a special effort to praise students who are mathematically correct in what they do or say, they take action to deal with signs of student discomfort or distress, they give frequent feedback on how well each student is doing, and when in front of the class, avoid being critical about the answers of an individual student. That Hawaii teachers more than Tokyo teachers appear to emphasize the needs of individual students is understandable in view of the emphasis given to group achievement

in contrast to individual achievement in Japanese society. As an example, in school competitions awards are made to groups, not to individuals.

Tokyo teachers compared to other objectives give more emphasis to having students become interested in mathematics, understand the nature of proof, develop an attitude of inquiry, and perform computations with speed and accuracy. Whereas, Hawaii teachers gave more emphasis to developing a systematic approach to solving problems, knowing mathematical facts, principles, and algorithms, and developing an awareness of the importance of mathematics in everyday life.

Hawaii and Tokyo teachers emphasize different classroom behavior in providing instruction, establishing and maintaining the engagement of students in instruction, tasks and activities, and in monitoring students' progress in learning, completing tasks. A different emphasis was not evident for providing instructional feedback to the students. In addition, Hawaii teachers compared to Tokyo teacher monitor students' progress in learning and provided instructional feedback a much greater percent of the time. This may in part account for the great amount of time Hawaii teachers use in grading papers. Both Hawaii and Tokyo teachers have a large percent (75% and 71% respectively) of students involved in instruction, however, in Tokyo this is true only for about 36% of the class time as compared to about 75% in Hawaii. The lower percent indicated by Tokyo teachers may be due to their interpretation of the question. Perhaps they interpreted the question to mean the

percent of classtime students are involved with the teacher in the developmental phase of the lesson, therefore they disregarded activities such as correcting homework, review and drill work. On the other hand Hawaii teachers may be responding to what they considered to be a realistic but ideal situation.

The calculator is not widely used in Tokyo or Hawaii classrooms. This is in spite of the fact that in Japan the Ministry of Education is encouraging the use of calculators in mathematics classroom through its Course of Study and through financial support to schools for equipment*; and in Hawaii the State Mathematics Program Guide (HDOE, 1979) and the recommendations of the National Council of Teachers of Mathematics (NCTM, 1980) both encourage school mathematics programs to take full advantage of the power of calculators. One of the reasons why the calculator is not widely used in Tokyo is that school policy might forbid its classroom use. However when calculators are provided by the school, calculators are still not frequently used. Perhaps teachers tend to be more theory-oriented than practical-oriented**. That is, they emphasize the understanding of mathematical concepts and regard applications only as examples for illustrating those concepts, whereas practical-oriented teachers emphasize the practical side of mathematics and make an effort to include as much as possible certain aspects of model-making into their teaching.

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* Information provided by N.I.E.R.

** Suggested by Professor Shigeru Shimada in "Mathematics Education Information Report --- International Calculator Review ---" by ERIC/SMEAC, March 1980

In summary, Hawaii and Tokyo teachers emphasized different classroom behavior and were notably different in many other ways. Whether any of these differences are causally related to the differences in student achievements is not yet known, however, this study revealed the prime candidates for further (causal) studies.

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APPENDIX A

TEACHER CLASSROOM BEHAVIOR

TEACHER BACKGROUND: Answer each question by writing your responses in the space provided.

1. Sex: _____

2. Age: _____ (years)

3. Teaching Experience (include current year). Express part-time experience as full-time equivalent and round to the nearest year: _____ (number of years)

4. Years of Experience Teaching Mathematics (round to the nearest year): _____ (number of years)

5. Post-Secondary Education: State the number of courses (not credit hours) taken:

   a. Mathematics: _____ Number of Courses

   b. Mathematics Methods and Pedagogy: _____ Number of Courses

   c. General Methods and Pedagogy (exclude those identified in 5b): _____ Number of Courses

PART I: In a typical (regular) class period, in my _____ class, I:

1. State what students are to learn in the lesson.

   Always Frequently Sometimes Occasionally Never

2. Outline the lesson before proceeding.

   Always Frequently Sometimes Occasionally Never

3. Explain concepts, definitions, relationship of tasks to goals, etc.

   Always Frequently Sometimes Occasionally Never

4. Review goals, previously related work, etc.

   Always Frequently Sometimes Occasionally Never

5. Illustrate how to do the work, how to do a problem, etc.

   Always Frequently Sometimes Occasionally Never

6. Question students to see if they understand.

   Always Frequently Sometimes Occasionally Never

7. Answer student's questions about what they are to do.

Always Frequently Sometimes Occasionally Never

8. Summarize what was presented, what the class has done or learned, etc.

Always Frequently Sometimes Occasionally Never

9. Move the class quickly from one activity or lesson to another.

Always Frequently Sometimes Occasionally Never

10. Tell students to attend to tasks (whole class or individually).

Always Frequently Sometimes Occasionally Never

11. Explain the rules of behavior.

Always Frequently Sometimes Occasionally Never

12. Signal students to get to work (turn off lights, eye contact, etc.).

Always Frequently Sometimes Occasionally Never

13. Encourage students to keep up (maintain pace).

Always Frequently Sometimes Occasionally Never

14. Sustain momentum in the lesson, not letting it slow down.

Always Frequently Sometimes Occasionally Never

15. Adjust instruction (faster/slower) according to students' speed.

Always Frequently Sometimes Occasionally Never

16. Scan the room to see if everyone is working.

Always Frequently Sometimes Occasionally Never

17. Review students' work when it is completed.

Always Frequently Sometimes Occasionally Never

18. Monitor students' responses.

Always Frequently Sometimes Occasionally Never

19. Roam the room, checking students' work.

Always Frequently Sometimes Occasionally Never

20. Question students: learned a concept, learned a fact, completed work.

Always Frequently Sometimes Occasionally Never

21. Collect students' work.

Always Frequently Sometimes Occasionally Never

22. Tell students their work (answer) is correct or incorrect.

Always Frequently Sometimes Occasionally Never

23. Provide answer "key" so that students can check work (answers).

Always Frequently Sometimes Occasionally Never

24. Model appropriate responses for students.

Always Frequently Sometimes Occasionally Never

25. Demonstrate how to complete work correctly.

Always Frequently Sometimes Occasionally Never

PART II: In a typical class period:

1. I establish and maintain the involvement of

   25% 50% 75% 100% (please circle one)

   of the students in instruction, tasks, and activities

   25% 50% 75% 100% (please circle one)

   of the class period.

2. For about what percent of students do you:

   a. Monitor progress in learning and completing tasks: ( )%

   b. Provide instructional feedback? ( )%

Part III

1. What is your total number of teaching periods (i.e., class contact periods) per week?

   Number of Periods ☐☐

2. How many of these periods per week do you spend teaching mathematics?

   Number of Periods ☐☐

3. In addition to teaching mathematics, do you have any of the following duties?

	Yes	No
a. Teacher of science.	☐	☐
b. Teacher in other areas.	☐	☐
c. Chairman, Mathematics Department.	☐	☐
d. School Administrator - General.	☐	☐
e. School Administrator - Subject Area	☐	☐
f. Other. If yes, please explain.	☐	☐

4. What is the average length of each class period (in minutes)?

   Number of Minutes ☐☐☐

5. How would you characterize the main mathematics subject matter taught in the class? (Check one)

   Remedial ☐

   Typical ☐

   Enriched or Accelerated ☐

6. Think about what you did with the class last week and during whatever you consider a typical week. In both cases, ESTIMATE THE NUMBER OF MINUTES spent by you on each of the following:

   Preparation and planning for mathematics (OUTSIDE class contact time and not including time spent grading papers and routine marking of homework).

   Last Week ☐☐☐ mins. Typical Week ☐☐☐ mins.

Grading student papers, quizzes, and tests OUTSIDE class.

Last Week ☐☐☐ mins. Typical Week ☐☐☐ mins.

Explaining mathematics content NEW to the class (to more than one student at a time).

Last Week ☐☐☐ mins. Typical Week ☐☐☐ mins.

Reviewing mathematics content NOT NEW to the class (with more than one student at a time).

Last Week ☐☐☐ mins. Typical Week ☐☐☐ mins.

Routine administration (e.g., marking roll, making school announcements, setting up equipment, etc.).

Last Week ☐☐☐ mins. Typical Week ☐☐☐ mins.

Establishing and maintaining class order and disciplining students during class time.

Last Week ☐☐☐ mins. Typical Week ☐☐☐ mins.

7. In a typical week, during an average complete period in the class, how many DIFFERENT students did you call upon to answer oral questions? (Check one)

Up to 1/4 of the class: ☐

More than 1/4, up to 1/2: ☐

More than 1/2, up to 3/4: ☐

More than 3/4 of the class: ☐

8. How often are some students in the class asked to do exercises or problem assignment which are different from those given other students in the class? (Check one)

Frequently ☐

Occasionally ☐

Rarely or Never ☐

9. How many hours per week do you think have been needed by a typical student in the class to complete the assigned homework (i.e., work to be completed outside class contact hours)?

Last Week - Number of Hours ☐☐

Typical Week - Number of Hours ☐☐

10. Approximately what percent of your time do you spend in a class period:

a.	Checking homework	( )%
b.	Lecturing or explaining to the whole class	( )%
c.	Having children work individually	( )%
d.	Having children work in groups	( )%
e.	Explaining new homework	( )%
f.	Others	( )%
	TOTAL	100%

PART IV

Below you will find suggestions of what teachers might do to make their teaching more effective. Please rate each item as if you were selecting a shorter list of the more important items to emphasize with student teachers and others who are interested in effective teaching.

Circle the appropriate number for each item as follows

4 Among the highest in importance
3 Of major importance
2 Of some importance
1 Of little or no importance

1.	Take time to talk to individual students about the feelings they have toward mathematics class.	4	3	2	1
2.	Stimulate competition among students.	4	3	2	1
3.	Give less able students assignments that are simple enough that they can progress without making many mistakes.	4	3	2	1
4.	Make a special effort to praise students who are mathematically correct in what they say or do.	4	3	2	1
5.	Plan transitions from one activity to another.	4	3	2	1
6.	Make encouraging remarks to individual students as they work.	4	3	2	1
7.	Change activities during a lesson if the students are not paying attention.	4	3	2	1
8.	Assign problems which require the abler students to do more than follow examples that have already been demonstrated.	4	3	2	1
9.	Immediately correct false statements made by students.	4	3	2	1
10.	At the end of a period, summarize the material that has been taught during the period.	4	3	2	1
11.	Present the content in a highly structured fashion.	4	3	2	1
12.	Take action to deal with signs of student discomfort or distress.	4	3	2	1
13.	Establish and enforce clear cut rules for acceptable student behavior.	4	3	2	1
14.	Vary the difficulty of questions posed in classroom discussion.	4	3	2	1

15.	Give frequent feedback on how well each student is doing.	4	3	2	1
16.	Think about how to clear up instructional problems which have arisen in the course of a previous lesson.	4	3	2	1
17.	Try to develop warm, personal relationships with students.	4	3	2	1
18.	Allow discussions to continue longer than planned when students show particular interest.	4	3	2	1
19.	Provide an opportunity for students to discover concepts for themselves.	4	3	2	1
20.	Get materials, equipment, and space ready before class.	4	3	2	1
21.	At the beginning of the period, outline the content to be covered.	4	3	2	1
22.	Make presentations as lively as possible.	4	3	2	1
23.	In planning a lesson, try to anticipate the questions that students might pose during class.	4	3	2	1
24.	When in front of the class, avoid being critical about the answers of an individual student.	4	3	2	1
25.	Call on students who do not volunteer to answer questions.	4	3	2	1
26.	Ask questions to determine the specific weaknesses of less able students and assign tasks accordingly.	4	3	2	1
27.	Write meaningful comments as well as grade on student work.	4	3	2	1
28.	Offer special encouragement to girls to do well in mathematics.	4	3	2	1
29.	Intervene swiftly at the first sign of students fooling around.	4	3	2	1
30.	Have something good to say about the answers students give in class, regardless of whether the answers are correct or incorrect.	4	3	2	1
31.	Change the sequence and duration of activities for the sake of variety.	4	3	2	1
32.	Give abler students assignments with some problems which are truly difficult for them to solve.	4	3	2	1
33.	Review tests with students shortly after the tests have been graded.	4	3	2	1

34.	Anticipate and forestall student disturbances before they occur.	4	3	2	1
35.	Make sure that students know exactly what they should be doing at any given time.	4	3	2	1
36.	Take student preferences into account when planning lessons.	4	3	2	1
37.	Be quick to stop students from discussing matters not closely related to the content of the lesson.	4	3	2	1
38.	Give assignments which are tailored to the particular instructional needs of individual students.	4	3	2	1
39.	Identify students who are in difficulty but do not ask for assistance.	4	3	2	1
40.	Try to convince students that mathematics is as appropriate for girls as for boys.	4	3	2	1
41.	Before an activity begins, give students detailed step-by-step directions on what they are to do.	4	3	2	1

PART V

1. In your school in which subject(s) is the use of calculators encouraged?

   Check one:

   - None ☐
   - Mathematics only ☐
   - Science only ☐
   - Mathematics and science ☐
   - All or most subjects where usage appropriate ☐

2. Which of the following best describes your department's policy on the use by students of 'four function' calculators in the mathematics classroom?

   - No policy formulated. Teachers allow use as they see fit. ☐
   - Students are forbidden to use calculators in the classroom. ☐
   - Students may use calculators but they are not provided by the school. ☐
   - Calculators are provided by the school but used only rarely in the classroom. ☐
   - Calculators are provided by the school and used frequently in the classroom. ☐
   - Question does not arise (e.g., calculators are not available to students). ☐

3. Which of the following best describes your department's policy on the use by students of pre-programmed multifunction and/or programmable calculators in the classroom?

   - No policy formulated. Teachers allow use as they see fit. ☐
   - Students are forbidden to use calculators in the classroom. ☐
   - Students may use calculators but they are not provided by the school. ☐
   - Calculators are provided by the school but used only rarely in the classroom. ☐
   - Calculators are provided by the school and used frequently in the classroom. ☐
   - Question does not arise (e.g., calculators not available to students). ☐

PART VI : In teaching your mathematics class this year, how much emphasis are you giving to each of the following objectives?

Indicate the appropriate number as follows:

1. Relatively more emphasis than most of the objectives listed.
2. About equal emphasis to most of the objectives listed.
3. Relatively less emphasis than most of the objectives listed.

☐ a. Understand the logical structure of mathematics.

☐ b. Understand the nature of proof.

☐ c. Become interested in mathematics.

☐ d. Know mathematical facts, principles and algorithms.

☐ e. Develop an attitude of inquiry.

☐ f. Develop an awareness of the importance of mathematics in everyday life.

☐ g. Perform computations with speed and accuracy.

☐ h. Develop an awareness of the importance of mathematics in the basic and applied sciences.

☐ i. Develop a systematic approach to solving problems.

Appendix B

"Juku" Questions

1. Estimate how many students in your school this year go to Juku institution. Please provide estimates for each grade.
2. What do you think about the merits and/or demerits of Juku schools?